API 1104 - Standard for Welding of Pipelines
Updates from the 21st Edition Committee

Southwest Gas Corporation
Mike Childers
Specialist
(Operations Staff/Corporate Engineering)
• History – The first API 1104 was published back in 1953

• Distribution – The Number one selling, and most widely used Industry Standard in the World.

• U.S. Federal Regulation: (PHMSA) – IBR: Sections 5, 6, 9, & A (All of A if used, not mandated to follow A)

• PHMSA NPRM to IBR Appendix A & B, (Annex A & B), and Section 12, into the CFR 192.225, 192.227 & 195.214, 195.222

• API 1104 Special Committee: revising Table 1 - Filler Metal Groups
• Majority of Cross-Country Pipelines are required to use the API 1104 (IBR Edition)

• Over the past 61 years there have been dramatic changes in the development of higher strength steel for Pipe and Fitting materials, and the development of high-productivity mechanized welding equipment. Many new long-distance transmission pipelines are constructed today using high-strength steel materials and using high productivity mechanized welding equipment, for many of these large scale pipeline projects the girth welds are inspected using automated ultrasonic testing (AUT) equipment.
## API 1104

### Current Federal Requirements

| (6) API Standard 1104, “Welding of Pipelines and Related Facilities” (20th edition, October 2005, errata/addendum, (July 2007) and errata 2 (2008)) | §§192.225; 192.227(a); 192.229(c)(1); 192.241(c); Item II, Appendix B. |

| §192.225  | Welding procedures – Section 5 |
| §192.227  | Qualification of welders – Section 6 |
| §192.229  | Limitations on welders – Section 6 or 9 |
| §192.241  | Inspection and test of welds —Section 9 or A |
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- PHMSA NPRM to IBR Appendix B (Annex B) In-Service Welding into the CFR 192 & 195.

The twenty-first Edition of API 1104 was not included in the recent notice of proposed rulemaking for incorporation by reference into the Federal Regulations. A review by subject matter experts within PHMSA recommended incorporating the Twenty-first Edition, but too late for the recent cycle. The Twenty-first Edition will be considered in the next cycle. Sections 5, 6, 9, and Appendix A are incorporated by reference, and the next cycle will request Annex B for incorporation by reference also.
The proposed code language changes are:

§192.225 – Welding procedures.
(a) Welding must be performed by a qualified welder or welding operator in accordance with welding procedures qualified under section 5, section 12, Appendix A or Appendix B of API Std 1104 (incorporated by reference, see §192.7) or section IX of the ASME Boiler and Pressure Vessel Code (ASME BPVC) (incorporated by reference, see §192.7) to produce welds meeting the requirements of this subpart. The quality of the test welds used to qualify welding procedures shall must be determined by destructive testing in accordance with the applicable welding standard(s).

§192.227 – Qualification of welders.
(a) Except as provided in paragraph (b) of this section, each welder or welding operator must be qualified in accordance with section 6, section 12, Appendix A or Appendix B of API Std 1104 (incorporated by reference, see §192.7) or section IX of the ASME Boiler and Pressure Vessel Code (ASME BPVC) (incorporated by reference, see §192.7). However, a welder or welding operator qualified under an earlier edition than the listed in §192.7 of this part may weld but may not requalify under that earlier edition.
As the API/AGA voting representative, AGA requested a response/opinion from its four AGA voting members, addressing the PHMSA NPRM pertaining to In-Service welding:

The group doesn’t believe this is a significant change, as it will now afford industry the opportunity to utilize the API 1104 Appendix B to both qualify in service welding procedures as well as to qualify in service welders, as an option. We believe this is an option since there is an “or” statement between, and we can NOW use either API 1104 section 5, section 12, Appendix A OR Appendix B. Without this language, we could actually be found to be out of compliance with the current regulations because many operators are currently utilizing API 1104 Appendix B to qualify their welding procedures and some are also qualifying in service welders with it. However, we would like to go on the record to state that this language should NOT be interpreted to mean that it is NOW a requirement to only utilize API 1104 Appendix B to qualify in service welding procedures or in service welders.
Task Group for Table 1 in API 1104
Report to Main Committee
Wednesday, January 28, 2015
Outline

- Background
- Task group members
- Recommendations to address electrode suffix designator issue
  - Suffix designator issue in general
  - “G only” suffix designator issue
- Letter ballot options
- Recommendations for updates and improvements to Table 1
Background – 1 of 2

- The inadvertent use of E8018 electrodes with “B” class suffix designators has resulted in a number of incidents
  - e.g., E8018-B9 electrodes (intended for welding 9% Cr-1% Mo steels) for welding Type B full-encirclement sleeves to an in-service pipeline
- There is currently no requirement in API 1104 to specify electrode suffix designators for AWS A5.5 specification electrodes, some of which can be very highly alloyed
- Other than “notes” in 5.4.2.2 and 5.4.2.6 (essential variables for base material and filler metal, respectively), there is currently nothing in API 1104 that prevents substituting E8018 electrodes with suffix designators commonly used for pipeline applications with those that are not appropriate – e.g., B9.
  - Electrodes with G suffix designator only can also be very highly alloyed (e.g., B9 “modified” sold as E8018-G)
- Primary purpose of the task group is to develop recommendations to address this issue, which will be included in an upcoming advisory bulletin from PHMSA
- Task group will also develop recommendations to incorporate other needed updates and improvements to Table 1 and related text
Background – 2 of 2

- Task group charge:
  - “To update Table 1 and related text in API 1104 to address the issue of electrode suffixes for AWS A5.5 specification electrodes and to incorporate other needed updates and improvements”

- Precaution - need to be careful that we do not make changes that result in onerous requirements to requalify welding procedures
API 1104

Task Group Members

- Kevin Beardsley – Lincoln Electric
- Matt Boring – Applus RTD/Kiefner
- Bill Bruce – DNV GL – Chair
- Mike Childers – Southwest Gas
- Don Drake – ExxonMobil
- Marshall Farley – Consumers Energy (ret.)
- Robert Gatlin – Welding Robotic Solutions
- Bob Huntley – RMH Welding Consulting
- Robert Lazor – TransCanada PipeLines
- Jon Lee – Chevron
- David Preston – EN Engineering
- Perry Sheth – National Grid

- Observers
  - Ed Baniak – API
  - Tim Burns – Shell

- Four task group meetings to date (including this morning)
Current Requirements in Section 5 – 1 of 2

- Specification Information for Filler Metal in 5.3.2.5
  5.3.2.5 Filler Metal, Flux, and Number of Beads
  The sizes and classification number of the filler metal and flux and the minimum number and sequence of beads shall be designated.

- Essential Variable for Filler Metal in 5.4.2.6
  5.4.2.6 Filler Metal
  The following changes in filler metal constitute essential variables:
  a) a change from one filler metal group to another (see Table 1);
  b) for materials with a SMYS greater than or equal to that of the material specified as API 5L Grade X65, a change in the AWS classification of the filler metal (see 5.4.2.2).

  Changes in filler metal within filler metal groups may be made within the material groups specified in 5.4.2.2. The compatibility of the base material and the filler metal should be considered from the standpoint of mechanical properties.

- Material Groupings in 5.4.2.2
  a) SMYS less than or equal to that of the material specified as API 5L Grade X42;
  b) SMYS greater than that of the material specified as API 5L Grade X42 but less than that of the material specified as API 5L Grade X65;
  c) for materials with a SMYS greater than or equal to that of the material specified as API 5L Grade X65, each grade shall receive a separate qualification test.

  NOTE 1. The groupings specified in 5.4.2.2 do not imply that base materials or filler metals of different analyses within a group may be indiscriminately substituted for a material that was used in the qualification test without consideration of the compatibility of the base materials and filler metals from the standpoint of metallurgical and mechanical properties and requirements for preheat and PWHT.
### Current Requirements in Section 5 – 2 of 2

#### Table 1—Fill Metal Groups

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*NOTE: Other electrodes, filler metal, and fluxes may be used but require separate procedure qualification.*

$^a$ Any combination of flux and electrode in Group 4 may be used to qualify a procedure. The combination is identified by its complete AWS classification number, such as E7010 EL12 or E7010 EM15K. Only substitutions that are the same AWS classification number are permitted without requalification.

$^b$ A shielding gas (see 8.4.2.10) is required for use with no electrode in Group 5.

$^c$ In the flux designation, the X can be either an A or F for as-welded or postweld heat treated.

$^d$ For root pass welding only.
### Improved Format for Table 1

**Table 1 – Filler Metal Groups**

<table>
<thead>
<tr>
<th>Group</th>
<th>AWS Specification</th>
<th>AWS Classification</th>
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<th>Flux *</th>
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</table>

**NOTE:** Other electrodes, filler metals, and fluxes may be used but require separate procedure qualification.

- Any combination of flux and electrode in Group 4 may be used to qualify a procedure. The combination is identified by its complete AWS classification number, such as F6X0-1102 or RG4-1102. Only substitutions that result in the same AWS classification number are permitted without requalification.
- A shielding gas (see 5.4.1.10) is required for use with the electrodes in Group 5.
- c: The flux designation, the K can be either an A or P for air-cooled or post weld heat treated.
- d: For root pass welding only.
**Suffix Designators**

- AWS A5.1 and A5.5 suffixes designators commonly used (or could be used without concern) for pipeline applications* include:
  - No suffix designator
  - -1 – improved impact toughness at -40°F
  - A1 – Carbon-Moly Steel
  - C1, C2, C3, C1L, C2L, C3L – Nickel Steel
  - G – General Low-Alloy Steel
  - M – Military-Similar
  - P1 – Pipeline Steel (Cellulosic)
  - P2 – Pipeline Steel (Low Hydrogen)

- Other suffixes designators in AWS A5.5 are generally not appropriate for pipeline applications

- We need to prevent a change from one of these 13 possibilities to anything else, and vice versa, without requalification

<table>
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<th>Suffix Designator</th>
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<td>C1, C2, C3, C1L, C2L, C3L – Nickel Steel</td>
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<td>G – General Low-Alloy Steel</td>
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* still taking “notes” in 5.4.2.2 and 5.4.2.6 into account
Proposed Resolution to Electrode Suffix Designator Issue in General

- Make the following changes in red to 5.4.2.6 (essential variables for filler metal):
  
  5.4.2.6 Filler Metal
  
  The following changes in filler metal constitute essential variables:
  
a) a change from one filler metal group to another (see Table 1);

b) for Groups 1 through 3 in Table 1, any change in suffix designator except within the group consisting of: no suffix designator; -1, A1, C1, C2, C3, C1L, C2L, C3L, G, M, P1, or P2;

  NOTE For example, a change in suffix designator from A1 to B3, or vice versa, constitutes an essential variable. A change from A1 to C3, or vice versa, does not constitute an essential variable.

  c) for materials with a SMYS greater than or equal to that of the material specified as API 5L Grade X65, any change in the AWS classification of the filler metal (see 5.4.2.2).

  Except as indicated in b) above, changes in filler metal within filler metal groups may be made within the material groups specified in 5.4.2.2, items a) and b). The compatibility of the base material and the filler metal should be considered from the standpoint of mechanical properties.
Proposed Resolution to “G only” Electrode Suffix Designator Issue

- Make the following additional changes in green to 5.4.2.6 (essential variables for filler metal):

**5.4.2.6 Filler Metal**

The following changes in filler metal constitute essential variables:

a) a change from one filler metal group to another (see Table 1);

b) for Groups 1 through 3 in Table 1, any change in suffix designator except within the group consisting of: no suffix designator, -1, A1, C1, C2, C3, C1L, C2L, C3L, M, P1, or P2;

   **NOTE** For example, a change in suffix designator from A1 to B3, or vice versa, constitutes an essential variable. A change from A1 to C3, or vice versa, does not constitute an essential variable.

c) for any filler metals with a G suffix designator only, a change in the manufacturer or trade name.

d) for materials with a SMYS greater than or equal to that of the material specified as API 5L Grade X65, any change in the AWS classification of the filler metal (see 5.4.2.2).

*Except as indicated in b) and c) above,* changes in filler metal within filler metal groups may be made within the material groups specified in 5.4.2.2, items a) and b). The compatibility of the base material and the filler metal should be considered from the standpoint of mechanical properties.
Proposed Resolution to “G only” Electrode Suffix Designator Issue – 2 of 3

- Also make the following change in green to 5.3.2.5 (specification information for filler metal):

5.3.2.5 Filler Metal, Flux, and Number of Beads
The sizes and classification number of the filler metal and flux and the minimum number and sequence of beads shall be designated. For any filler metals with a G suffix designator only, the manufacturer and trade name shall also be designated.
Letter Ballot Options

▪ Single letter ballot
  – Someone may agree with resolution to electrode suffix designator issue in general but not resolution to “G only” suffix designator issue

▪ Two letter ballots – options per Ed Baniak
  – The best way to handle this is with two separate ballots.
    – Option A – The cleanest way is to run them separately...i.e., run the first ballot and if it passes, then run the 2nd. But this will extend the process by another 6 weeks for the 2nd ballot.
    – Option B – The other way is to run simultaneous ballots. But for the 2nd one, you will need to make is clear that the actions resulting from it will ONLY be actioned if the 1st ballot passes. This would require the task group to do comment resolution on two ballots at the same time.
    – Both ways are possible. Even though these are in separate ballots, we can make the resulting changes (assuming the both pass) in one addendum.
    – So it is your call...depends on how urgent the changes are and if you want to work two ballots at the same time.

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Updates and Improvements to Table 1

- Initial progress of work to develop updates and improvements to Table 1 resulted in the realization that a rethink of the entire essential variable requirements for filler metal is required
  - Simply adding new classifications may result in allowable changes that are unsound
    - e.g., E6018 to E9018-P2 and vise versa
    - Need to rethink what changes should and should not be allowed without requalification
- Task group will discuss with subcommittees for Section 5 and 12 and continue to work this issue
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Summary

- Motion for a letter ballot to address electrode suffix designator issue in general
- Motion for a letter ballot to address “G only” electrode suffix designator issue
- Continue work to develop updates and improvements to Table 1
  - Including a reevaluation of essential variable requirements for filler metal in general
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Authors

• Committee Members— Representatives from the Oil & Natural Gas Industry.
• API/AGA Committee Voting Members- Consists of 28 appointed Subject Matter Experts (SME’s) from seven categories, four from each: API, AGA, Pipeline Contractors Association, Pipe Manufacturers, American Society for Nondestructive Testing, American Welding Society, and General Interest.

Subcommittees:

• Fracture Mechanics
• Maintenance Welding
• Mechanized Welding
• Nondestructive Testing
• Repair Welding Task Group
• Modification, Interpretation & Policy
• Welding Procedures & Welder Qualification
• General Interest Members
• 21st Edition Editorial Group
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<td>Robert Lazor</td>
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<td>Charlie Ribardo</td>
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<td>Samar Saha</td>
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<td>Donald Stevens</td>
<td>General Interest</td>
<td>D. M. Stevens &amp; Associates</td>
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<td>Don Thom</td>
<td>Pipeline Contrai</td>
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<td>Yung-Yi Wang</td>
<td>General Interest</td>
<td>CRES (Center for Reliable Energy Systems)</td>
<td>Yes</td>
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<td>Bob Wise</td>
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<td>Ronnie Wise</td>
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<td>Price Gregory International, Inc.</td>
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<td>C. P. Woodruff</td>
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# API Ballot Summary Sheet

**5/23/2014**

**Ballot:** API 1104 - Addendum 1  
**Ballot ID:** 3224  
**Associate:** Edmund Baniak  
**Coordinator:** Edmund Baniak

## Proposal:

### Voting Category

<table>
<thead>
<tr>
<th>Balloting Totals</th>
<th>Affirmative</th>
<th>Negative</th>
<th>Abstain</th>
<th>Did Not Vote</th>
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<tr>
<td></td>
<td>25</td>
<td>0</td>
<td>1</td>
<td>2</td>
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</table>

- **Total Responses:** 26  
- **Total Ballots:** 28  

**Response Rate** ((Affirmative + Negative + Abstain) / Total Ballots): 

- 93%  
  Must be > 50%

**Approval Rate** (Affirmative / [Affirmative + Negative]): 

- 100%  
  Must be >= 66.66%

**Consensus:** YES
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<tr>
<th>#</th>
<th>Name</th>
<th>Affirmative</th>
<th>Figure</th>
<th>Type of Comment</th>
<th>Comment</th>
<th>Proposed Change</th>
<th>Comment Resolution</th>
<th>Attachment</th>
<th>Company</th>
<th>Email</th>
<th>Phone</th>
<th>Country</th>
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<tr>
<td>1</td>
<td>Addison, Ryan</td>
<td>Affirmative</td>
<td>b.4</td>
<td>General</td>
<td>Removal of Note 1 is agreed, however, no mention of avoiding thermal cutting methods is mentioned.</td>
<td>Suggest including comment to avoid thermal cutting methods.</td>
<td>Disagree</td>
<td>Tencos Coiled Tubing, LLC Downton Facility</td>
<td><a href="mailto:radisson@tencons.com">radisson@tencons.com</a></td>
<td>1 231 458-2089</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Addison, Ryan</td>
<td>Affirmative</td>
<td>b.4</td>
<td>General</td>
<td>There does not appear to be a benefit in removing the size call-out of Note 2. A minimum size needs to be stated, keeping in mind the required tests. Otherwise the requirements for specimen preparation potentially won’t be met as per 5.6 or 5.6.1.</td>
<td>Suggest retaining the information of Note 2 somewhere within the Figure in some way.</td>
<td>Disagree</td>
<td>Tencos Coiled Tubing, LLC Downton Facility</td>
<td><a href="mailto:radisson@tencons.com">radisson@tencons.com</a></td>
<td>1 231 458-2089</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Wang, Yong-Yi</td>
<td>Abstain</td>
<td>B-4</td>
<td>General</td>
<td>The subject is not in the area of my expertise.</td>
<td>None</td>
<td>Noted. No proposal changes identified by commenter.</td>
<td>CREES (Center for Reliable Energy Systems)</td>
<td><a href="mailto:nwang@crees-americas.com">nwang@crees-americas.com</a></td>
<td>514 808-4872</td>
<td>United States</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Wang, Yong-Yi</td>
<td>Abstain</td>
<td>B-4</td>
<td>General</td>
<td>The subject is not in the area of my expertise.</td>
<td>Note</td>
<td>Noted. No proposal changes identified by commenter.</td>
<td>CREES (Center for Reliable Energy Systems)</td>
<td><a href="mailto:nwang@crees-americas.com">nwang@crees-americas.com</a></td>
<td>514 808-4872</td>
<td>United States</td>
<td></td>
</tr>
</tbody>
</table>
API 1104
Addendum / Errata

• Errata issued as needed — No Ballot

• Addenda (changes) Proposed, as needed—Ballot

• Changes can be new additions (section or annex) or revision to existing text.

• API posts all Addendum and Errata (free)

API 1104
Addendum / Errata

Pipeline Transportation Addenda/Errata Publications

  Errata 5, March 2014

  Addendum 1, July 2014
  Errata 3, July 2014

RP 1109, Marking Liquid Petroleum Pipeline Facilities, Fourth Edition, October 2010
  Errata, November 2010

  Errata, July 2007

RP 1117, Recommended Practice for Movement of In-service Pipelines, 3rd Edition, July 2008
  Errata 1, December 2008
  Errata 2, August 2009

  Errata 1, September 2013

RP 1161, Recommended Practice for Pipeline Operator Qualification
  Updated Covered Task Lists

  Errata, December 2006
API 1104

ADDENDUM 1

Page 108, Figure B.4, replace the figure as follows:

Option 1:

Option 2:

NOTE 1  NB = nick break; SB = side bend; MT = macro test; FB = face bend

NOTE 2  The area of simulated wall loss should be of sufficient size to remove all the required test specimens and may consist of a single larger area (Option 1) or multiple smaller areas (Option 2).

Figure B.4—Suggested Location of Test Specimens for Weld Deposition Repair
API 1104

ERRATA 2
(Incorporates changes in Errata 1, April 2014 and Errata 2, June 2014)

Page 12, Section 5.3.2.3, second sentence, replace:
Groupings are shown in 6.2.2 d) and 6.2.2 e).

with
Examples of suggested groupings are shown in 6.2.2 d) and 6.2.2 e).

Page 27, Figure 12, replace the figure:

Page 46, Section 10.3.4 h), replace:
h) Time delay, if any, before final inspection. The time delay specified in 10.3.3 is not required for repair welding.

with
h) Time delay, if any, before final inspection.

Page 52, Figure 20, replace the figure:

NOTE: HAZ hardness impressions shall be entirely within the heat-affected zone and located as close as possible to the fusion boundary (between the weld metal and heat-affected zone).

Page 57, Section 11.1.5, replace the NOTE with:

NOTE: For purposes of IQI selection, when the SWE/GWV or DWE/GWV technique is used, the thickness of the weld means specified wall thickness plus the weld reinforcement (internal plus external combined). When the "elliptical" DWE/GWV technique is used, the thickness of the weld means twice the specified wall thickness plus the single weld reinforcement (internal plus external combined). When the "superimposed" DWE/GWV technique is used, the thickness of the weld means twice the specified wall thickness plus twice the weld reinforcement (internal plus external combined).

Page 85, Section A.3.3, replace:
...multiple pipe materials as defined by A.3.1 b) may...

with
...multiple pipe materials as defined by A.3.2 b) may...

Page 90, delete Section A.3.4.4.

Page 103, Section B.1, 6th paragraph (continued from previous page), replace the second sentence:
The previously mentioned thermal analysis computer models or other proven...

with
The previously mentioned thermal analysis computer models or other proven...

Page 103, Section B.2.2.1.1, delete the second paragraph.
Page 105, Figure B.2, replace the value on the arrow:
45, 5
with
45° ±5°

Page 105, Figure B.2, NOTE, replace:
NOTE This test position qualifies the procedure for all positions. Tests may be performed in other positions that qualify the procedure for that position only.
with
NOTE For a single in-service welder qualification, this test qualifies the welder for all positions. Tests may be performed in other positions which will qualify the welder for that position only.

Page 109, Section B.2.5.2, second sentence, replace:
The face bend specimens should be bent in a guided-bend test jig similar to that shown in Figure 9.
with
The face bend specimens should be bent in a guided-bend test jig similar to that shown in Figure 8.

Page 110, Figure B.6, NOTE 1, replace:
Test specimens may be machine cut or oxygen cute oversized and machined (see B.2.4.5.1).
with
Test specimens may be machine cut or oxygen cut oversized and machined (see B.2.5.5.1).
API 1104

Revisions and Interpretations

• API 1104 is revised regularly (*every five years) to adapt to changing pipeline construction practices. In spite of these revisions, there are many requirements in API 1104 that are subject to interpretation. (Official Interpretations of the API 1104 can only come from the API 1104 Interpretations Committee, and/or API Staff.

• Interpretations/Modifications Subcommittee was dissolved and replaced with the Interpretations Task Group (ITG)

• ITG Membership includes Committee Leadership and the Subcommittee Co-chairs.

• Chair of the 1104 is the Chair of the ITG (unless delegated)

• ITG meets 2-4 times per year, as needed, to reply to Interpretations Requests. Face-to-Face Meeting not Needed.

• ITG addressed the time lag from Submission of Interpretations Request to Issuance of the Interpretation (some issues took over a year)

• ITG will Meet at the 1104 Meeting Annually
• **Annex C** - Requests for Interpretation and Request for Revision to the Document.

• Must follow all requirements of Annex C

• Only Interpretations of the API 1104

• Not designed to provide technical Welding consultation.

---

Standards Department
API
1220 L Street, NW
Washington, DC 20005
Standards@API.org
API 1104
Definitions

• Shall: As used in a standard, “shall” denotes a minimum requirement in order to conform to the specification. (API definition)

• Should: As used in a standard, “should” denotes a recommendation or that which is advised but not required in order to conform to the specification. (API definition)
## API 1104

### Contents

1) **Scope**

2) **Normative References**

3) **Terms, Definitions, Acronyms, and Abbreviations**

4) **Specifications**

5) **Qualification of Welding Procedures with Filler Metal Additions**

6) **Qualification of Welders**

7) **Design and Preparation of a Joint for Production Welding**

8) **Inspection and Testing of Production Welds**

9) **Acceptance Standards for NDT**

10) **Repair and Removal of Weld Defects**

11) **Procedures for Nondestructive Testing**

12) **Mechanized Welding with Filler Metal Additions**

13) **Automatic Welding Without Filler Metal Additions**

**Annex A**—**Alternative Acceptance Standards for Girth Welds**

**Annex B**—**In-service Welding**

**Annex C**—**Request for Interpretation and Request for Revision to the Document**
API 1104
Review

- Several new referenced documents.
- Harmonized language, and terminology with other API, and Industry recognized Standards
- Added Several Acronyms and Abbreviations
- Repair procedures, terminology, and definitions.
- Forced cooling requirements (Section 5)
- Base Material Descriptions and new Note:
  - New format for the Tables
  - Reduced Section Tensile Strength Test Specimen requirements (Section 5)
  - Alternate (smaller) bend radius permitted for bend test
  - Welder Qualification test specimens cannot contain the longitudinal weld (Section 6)
API 1104
Review Continued

• Requirement for Vision Examinations of all NDT personnel (Section 8.4.3)
• Repair of Cracks and Defects other than cracks.
• Qualification of Weld Repair Procedures
• Repair Welder Qualification
• Note for proper IQI selection for each process SWE/SWV, DWE/SWV or DWE/DWV.
• Ultrasonic Testing for Mechanized Welding
• Annex A – New Essential Variables Chemical Composition Chart. More descriptive language added to the Annex.
• Annex B – (Guidance for Weld deposition repair WDR, Bill Bruce & Bill Amend) (W.A. Bruce and W.E. Amend, “Guidelines for Pipeline Repair by Direct Deposition of Weld Metal,” WTIA/APIA Welded Pipeline Symposium, Welding Technology Institute of Australia, Sydney, Australia, April 3, 2009.)
• New Annex C - Request for Interpretation and Request for Revision to the Document
Thank you.
Questions?

Mike.Childers@SWGas.com